PARTS SPECIFICATION

CODE IDENT NO. 23835
SPEC NO. CS515579 REV F
ISSUE DATE _____
SUPERSEDING CS515579 E
DATED 14 October 1992

RELAYS, ELECTROMAGNETIC
LOW LEVEL TO 10 AMPERE
GENERAL SPECIFICATION FOR

ENGINEER: J. WILSON DATE
Section 514 Discrete Parts and
Integrated Circuits

RELEASED BY: J.W. ANDERSON DATE
Section 648 Technical Editor
Documentation Section

APPROVED BY: S. SOLLOCK DATE
Section 514 Supervisor,
Discrete Parts and Integrated
Circuits

JET PROPULSION LABORATORY
CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA CALIFORNIA

CHANGE INCORPORATION LOG

CHG LTR	RELEASED BY		AUTHORITY	PAGES AFFECTED	DATE	ENGINEERING APPROVAL	
	INIT.	SEC.				INIT.	SEC.
A	JWA	648	STANDARD	INIT. RELEASED	08-03-92	JTRW	514

B	JWA	648	STANDARD	ALL	11-27-91	JTRW	514
C	JWA	648	STANDARD	ALL	01-28-92	JTRW	514
D	JWA	648	STANDARD	ALL	08-05-92	JTRW	514
E	JWA	648	STANDARD	ALL	10-14-92	JTRW	514
F	JWA	648	STANDARD	ALL		JTRW	514

CONTENTS

1. SCOPE

1.1 Content. This document establishes the general manufacturing and testing requirements for electromagnetic relays with contact ratings of 10 amperes and less. MIL-R-39016 is used as the baseline; this document lists exceptions to it and adds requirements to make it suitable for the acquisition of relays to meet the quality and reliability requirements of JPL Mission Class A and B missions. An optional lot qualification flow is provided for procurement of relays from manufacturers who are not qualified (as defined by MIL-R-39016) at an acceptable level. Portions of MIL-R-39016 which are not specifically deleted herein or are not specifically incorporated as a tested requirement, are hereby incorporated as a design requirement only. (Any requirement for lot QCI will be specified in the detail specification or the procurement document.) Detail requirements, specific characteristics of relays, and other provisions which are sensitive to the particular use intended shall be specified in the applicable detail specification. This document is not intended for qualification of parts (inclusion in the qualified products list, QPL) as defined by MIL-R-39016 or for listing on an approved parts list. Qualification status will, however, determine whether lot QCI will be required.

1.2 Military part number. Delete and substitute as follows:

1.2 Part number. The part number shall be marked in accordance with the JPL detail specification. The basic pattern shall be as follows:

33333-K333333XY

where:

33333 identifies the detail specification, excluding the letter prefix ("ST," e.g.)

K identifies the JPL descriptor code for the device family (K is for relays)

333333 is the generic or manufacturer's catalog part number (or a portion thereof) and, if possible, the coil voltage

X indicates the type of terminal and mounting:
- L = solder lug, no mounting flange
- M = solder lug, mounting flange
- P = pin, no mounting flange
- Q = pin, mounting flange

Y specifies whether the relay is latching or non-latching:
- L = latching
- N = non-latching

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. Delete the first two sentences and substitute as follows: "The failure rate level M and above requirements of

the following document, of the issue in effect at the time of bid , form a part of this specification unless exceptions are noted herein, in the detail specification, or in the procurement document. The specification of failure rate level M and above requirements does not imply that the manufacturer or product be MIL qualified to that failure rate level: it is intended only as a means of defining test requirements. The manufacturer may contact the JPL contract negotiator to obtain copies of this document."

SPECIFICATIONS

Military

MIL-R-39016	Relays, Electromagnetic, Established Reliability, General Specification for

2.3 Order of precedence. Delete and substitute as follows: "In the event of a conflict between the requirements of this document and other requirements, the precedence in which requirements shall govern, in descending order, is as follows:

a. Procurement document (contract or purchase order)

b. Applicable device specification (associated detail specification or drawing)

c. This specification

d. Specification and Standard referenced in 2.1."

Add paragraph 2.4 as follows:

2.4 General exceptions and clarifications. References to the U.S. Government and its agencies shall be taken to refer to JPL. The detail specification shall be the JPL detail specification. The requirements herein apply specifically to relays being processed for JPL: they do not apply to parts for other customers.

3. REQUIREMENTS

Requirements of Paragraph 3 apply with the exception of the following:

3.2 Qualification.

Add the following paragraphs:

3.2.1 Group B Quality Conformance Inspection (QCI). If lot QCI is required by the detail specification or the procurement document, the screened parts shall not be shipped until the inspection lot has passed the Group B quality conformance inspection of Table VI a. herein unless the JPL contract technical manager has given technical direction to ship ahead of QCI completion or unless prior shipment is required herein (e.g., catastrophic failures for analysis).

3.2.2 Data retention. All inspection data shall be retained by the manufacturer for a minimum of 5 years after performance of the inspection.

3.3 Materials. Add the following: "The manufacturer shall advise the JPL contract technical manager and contract negotiator of any changes in materials used as defined in the baseline document."

3.4 Design and construction.

3.4.2 Sealing process. Delete the second sentence and substitute as follows: "Sealing shall be by laser welding or by resistance welding. No adjunct sealers shall be used."

3.7 Solderability. Delete the second sentence and substitute as follows: "The remaining 5 percent of the total critical area shall not exhibit nonwetting, dewetting, porosity or foreign material; these shall not be concentrated in one area."

3.11.5 Operate and release time. Delete the third sentence and substitute as follows: "Double throw contacts shall show no evidence of any open contact closing before all closed contacts have opened in excess of 0.05 microseconds."

3.26 Particle Impact Noise Detection (PIND), when specified, See 3.1). Delete and substitute as follows:

3.26 Particle Impact Noise Detection (PIND). PIND is required. When relays are tested as specified in 4.8.23 or approved manufacturer's procedure, there shall be no evidence of free moving particulate contamination.

3.27 Marking. Delete 3.27 and all subparagraphs and substitute as follows:

3.27 Marking. Each relay shall be marked in accordance with Method I of MIL-STD-1285 and shall include the following information:

a. JPL part number in accordance with detail specification and paragraph 1.2 herein

b. Manufacturer's part number

c. Manufacturer's logo or name

d. Date code

e. Inspection lot number

f. Serial number

g. Circuit diagram"

Add the following paragraphs:

3.29 JPL review of manufacturer's documentation. Prior to relay build, the manufacturer shall develop and submit to JPL for approval a Base Line Document which defines the proposed relay and the testing regimen. The Base Line Document shall include, as a minimum, the requirements of paragraphs 3.29.1 through 3.37 where applicable. Any major changes, as defined in the baseline document, in approved documentation must be approved by technical direction from the JPL contract technical manager before they are implemented with JPL lots.

3.29.1 Manufacturer's drawings required for review. Drawings covering the following component parts shall be made available for review by JPL personnel:

a. Armature

b. Side plates

c. Pole pieces

d. Magnets

e. Cores

f. Coils

g. Contacts

h. Weld joints (including alignment after welding)
sideplate-to-pole pieces
magnet assembly-to-header
coil lead-cross-wire
magnet welds

i. Core installation and swaging

j. Relay subassemblies

3.29.2 Manufacturer's written procedures required for review. Written manufacturing procedures covering the following operations shall be made available for review by JPL personnel:

a. Plating processes and finishes

b. Magnetization

c. Coil winding

3.30 Data required with shipments. Data shall be identified by part number, lot number, trace number, and serial number range. The following data shall be included with each shipment of screened parts:

a. A copy of the completed lot traveler(s) used for screening and (if applicable) lot sample QCI, showing disposition of each serial number in the lot

b. A copy of attributes data for Group A and (if required) Table VI.a Group B quality conformance inspections

c. Electrical test data for all specified tests, including control unit data, delta calculations, and statistical calculations where applicable

d. Data for any other special tests required by the detail specification or procurement document

e. Copies of reports on any failure analyses or engineering evaluations performed by the manufacturer

f. Copies of any waivers or Technical Direction Memoranda (TDMs) altering the specified requirements

g. Certificate of conformance to the requirements of this specification, signed by the manufacturer's authorized representative

If tests are labeled with test numbers, a cross-reference shall be provided to relate test numbers to descriptive test name and contact set number. It is preferred that printed electrical test data be formatted such that all measurements of a given parameter are displayed in a column, in serial number order. Electrical test data also shall be provided in a magnetic medium: either IBM DOS-compatible 5-1/4" or 3-1/2" diskette with data in ASCII format or 9-track tape (800 or 1600 bpi) with data in ASCII or EBCDIC format. (If the requirement for magnetic data is waived, two copies of printed data shall be provided.)"

3.31 Serialization. Parts shall be serialized prior to the first electrical test in screening.

3.32 Control units. The control units shall be measured and recorded immediately before and after each set of electrical measurements of the test specimens. There shall be three (3) control units per lot. (It is preferred that the same control units be used for all JPL lots of the same device type.) Each set of control unit measurements shall be checked for consistency with the last prior set of control unit measurements before proceeding with testing of the lot. In the event of significant discrepancy between two readings, corrective action (maintenance or recalibration of the test equipment) and retest of control units shall be accomplished before proceeding with testing of the lot. Three control units shall be used for any required measurements during Group A electrical tests, and at completion of Group A, one control unit shall be randomly selected from the control units for control-unit use with required electrical measurements of Group B high-level-current and intermediate-current life tests. .

3.33 Problem notification. The contractor shall notify the JPL contract technical manager and the contract negotiator within two working days of the occurrence of any of the following during processing of a JPL lot.

a. Any catastrophic failure after initial electrical test

b. Any failure in Group B

c. Any need for re-marking serial numbers

3.34 Failure analysis. JPL retains the option of performing any failure analysis: the manufacturer shall not do any analysis destructive of the part without prior consent of the JPL contract technical manager.

3.35 Status reporting. The contractor shall provide the JPL contract technical manager and the contract negotiator every two weeks with an oral or written status report stating the current status (point on the lot traveler and quantity of parts in the lot) and expected ship date of each lot in process, and noting any significant problems.

3.36 Destructive Physical Analysis (DPA) samples. If Group B QCI is required, the manufacturer shall make available to the JPL contract technical

manager 3 samples from each JPL lot, immediately upon completion of Group A screening, for DPA. The manufacturer shall continue processing of the lot. There is no lot jeopardy associated with the results of JPL's DPA unless a defect is found which is unacceptable under the terms of the contract.

3.37 Disposition of Group A rejects. Relays which fail any of the inspections of Group A subgroups 2 through 4 shall be identified as to the test failed and retained separately with the lot data.

4. QUALITY AND RELIABILITY ASSURANCE PROVISIONS

Requirements of paragraph 4 apply with the exception of the following:

4.1 Responsibility for inspection. Add the following: "JPL QA source inspection is required at 3 points: (1) in-process visual inspection of motor and armature/magnet assembly ("in-process"), (2) prior to cleaning and seal ("pre-seal"), and (3); prior to shipment ("pre-ship"). The contractor shall notify JPL QA at least 2 working days in advance of the scheduled inspection time. Adequate inspection stations shall be provided for the JPL QA representative."

4.1.2 Reliability assurance program. Add the following: "JPL may perform a survey to ascertain compliance with the requirements of MIL-STD-790. Information regarding recent government audits, if any, shall be made available upon request. Any deviations from the approved program must be approved by technical direction from the JPL contract technical manager before the process in question has begun."

4.4 Qualification inspection. Applies only when invoked by the detail specification or purchase order .

4.5 Verification of qualification. Applies only when invoked by the detail specification or purchase order .

4.6 FR level determination. Applies only when invoked by the detail specification or purchase order .

4.7 Quality conformance inspection.

4.7.1 Inspection of product for delivery. Add the following: "If specified in the detail specification or procurement document, it shall consist of Group A and Group B (in accordance with Table VI a. herein) inspections."

4.7.1.1 Inspection lot.

Add the following paragraph:

4.7.1.1.1 Serialization and traceability. Each device shall be uniquely serialized prior to the initial electrical test in screening and shall be traceable to the inspection lot and date code.

4.7.1.2 Group A inspection. Add the following: "The following changes shall be made to Table V:

Electrical characteristics of subgroup 3 shall be recorded twice: once in the sequence shown but excluding DWV, and also prior to

the subgroup 2 stress tests (including DWV). Following the second set of measurements, Δ calculations shall be made, with limits set in accordance with Table V a. herein.

Thermal shock test in accordance with paragraph 4.8.3.4 shall be performed in subgroup 2 just prior to sinusoidal vibration.

Shock (specified pulse) test shall be performed in Subgroup 2 just after sinusoidal vibration and prior to PIND.

Random vibration is not required.

Subgroup 1 is required.

PIND (Subgroup 2) is required."

Add Table V a. as follows:

TABLE V a. Delta Limits for Group A Inspection

Parameter	Limit
Static contact resistance	±5 σ; ±3 σ *
Pickup or latch/reset voltage	±10%
Coil resistance at equivalent temperature	±3%
Operate and release time	±20%
Contact stabilization time: operate and release	±10% or ±1 millisecond whichever is greater

*Note: See paragraph 4.8.3.2.2 herein.

4.7.1.2.3 Manufacturer's production inspection. Does not apply: parts must be serialized prior to performance of these tests.

4.7.2 Periodic inspections. Applies only when invoked by the detail specification or purchase order .

4.7.2.1 Group B inspection. Add the following: "If Group B is required and one or more relays fail the Group B inspection, the manufacturer shall notify the JPL contract technical manager and contract negotiator within two working days."

4.7.2.1.1 Sampling plan. Applies only to qualified manufacturers. In addition to the two (2) control units, eight (8) samples shall be selected from each lot at the completion of Group A Inspection; two (2) samples shall be submitted for Subgroup 1, four (4) samples shall be submitted for Subgroup 2, and two (2) samples shall be submitted for Subgroup 3.

4.7.2.1.2 Disposition of sample units. Add the following: "If lot qualification test is required, samples used in Group B shall be retained by the manufacturer with the master file of data for the lot."

4.7.2.2 Group C inspection. Applies only when invoked by the detail specification or purchase order .

4.7.3 Inspection of packaging. Delete.

4.8 Methods of inspection.

4.8.2 Cleaning and small particle inspection (See 3.5). Add the following: "Cannular flushing may be required by the detail specification. JPL QA may witness the small particle inspection."

4.8.3 Screening (See 3.6).

4.8.3.2 Run-in.

4.8.3.2.2 Failure rate levels "M," "P," and "R." Modify as follows: "For Group A, the test shall be for 3,000 cycles at each temperature. Initially and after each 1,000 cycles, contact resistance shall be recorded for, and traceable to, each set of contacts, and the delta shall be calculated. At the completion of run-in, the distribution of measurements at each measurement point shall be plotted and standard deviation calculated. Relays having contact sets with measurements in excess of 5 sigma shall be removed from the lot and rejected. The standard deviation calculation shall be repeated with the balance of the lot and relays having contact sets with measurements in excess of 3 sigma shall be rejected."

Add paragraph 4.8.3.4 as follows:

4.8.3.4 Thermal shock. Relays shall be tested in accordance with MIL-STD-202 Method 107, test condition B except that the effective total transfer time between temperatures shall not exceed 2 minutes. During each high and low temperature step a run-in test of 50 operations "set" and 50 operations "reset," using $\leq$0.1A and $\leq$6.0V, shall be performed. Failure of a contact to operate correctly is cause for rejection of the relay. Upon conclusion of the test the relays shall be stabilized at room ambient temperature and a visual inspection performed. There shall be no evidence of cracking, peeling, or flaking of the relay finish.

Add Table VI a. Group B inspection for lot qualification as follows:

TABLE VI a. Group B Inspection for Lot Qualification

Inspection	Require-ment Paragraph	Test Method Paragraph	Sample Size	Failures Allowed
Subgroup 1				
Thermal shock	3.12	4.8.9	2	0
Vibration (sinusoidal)	3.14	4.8.11.1		
Dielectric withstanding voltage	3.10	4.8.7		
Insulation resistance	3.9	4.8.6		
Static contact resistance	3.11.1	4.8.8.1		
Specified pickup, hold, and dropout values (voltages)	3.11.2	4.8.8.2		
Coil resistance	3.11.3	4.8.8.3		
Operate and release time	3.11.5	4.8.8.5		
Contact dynamic characteristics	3.11.6	4.8.8.6		
Neutral screen (applicable to 2-coil-latching relays only)	3.11.8	4.8.8.8		
Seal	3.8	4.8.5		
Visual and Mechanical Inspection	3.1, 3.3, 3.4, 3.27 and 3.28	4.8.1		
Subgroup 2				
Life test, except 2 control units per 3.32, and Life test shall be as follows: 2 samples for high level (1A resistive and 28 Vdc), and 2 samples for resistive low level.	3.23	4.8.20	4	0
Subgroup 3				
Intermediate current	3.24	4.8.21	2	0

4.8.7 Dielectric withstanding voltage (See 3.10). Add the following: "DWV test shall be performed prior to the thermal shock test; DWV shall not be

performed after run-in nor in the 4.8.9 d. Examination after test of Thermal shock."

4.8.8 Electrical characteristics.

4.8.8.1 Static contact resistance (See 3.11.1). Add the following: "For relays rated ≤2A, this measurement shall be sequenced such that the contacts will make "dry," the current will be applied and the measurement recorded, the current will be removed, and the contacts will break "dry" (so as not to impair the dry circuit capability of the relay).

4.8.11.1 Vibration (sinusoidal). Modify as follows: b. shall read as follows: b. Electrical-load conditions - Relays shall be tested with the coil energized for 30 minutes at rated voltage and with the coil de-energized for 30 minutes , in each of the three mutually perpendicular directions (relays with intermediate duty coils shall not be energized above their duty cycle). Contacts shall be loaded as specified in d." "The optional procedure of ¶4.8.11.1 f shall not be used: all relays shall be tested in three mutually perpendicular planes."

5. PACKAGING. Delete and substitute as follows:

5. PACKAGING.

5.1 Protection. Each relay shall be individually packaged in a manner which will afford adequate protection against deterioration and physical damage during shipment and controlled storage. This may conform to the vendor's normal practice when such meets these requirements. Package marking shall include the following:

5.2 Marking. Add the requirement for marking the initial container (unit package, e.g., tube or bag) with the JPL trace number.

5.3 Packing slip and invoice. The packing slip and invoice shall include the JPL trace number associated with each line item.

5.4 Special marking of external shipping container. The external shipping container shall be marked "FLIGHT ELECTRONIC PARTS."

6. NOTES

Delete in entirety and substitute as follows:

6.1 Intended use. Relays conforming to this specification are intended for use when class S qualified parts are not available. When a relay is qualified for class S QPL listing, this specification shall not be used for new design.

6.2 Ordering data. Acquisition documents will specify the following:

a. Part number

b. Associated detail specification number

c. Any difference in test data requirements from those listed in 3.30 herein

d. Name and telephone number of JPL contract negotiator

e. Name and telephone number of JPL contract technical manager

f. Name and telephone number of JPL QA coordinator of source inspections

g. JPL trace number

h. Any other special requirements which differ from those indicated herein or in the detail specification (e.g., those involving source inspections, traceability, testing. etc.).

6.8 Glossary. Add the following definitions:

Contract technical manager. The contract technical manager shall be the principal technical interface between the manufacturer and JPL.

Control unit. A control unit is a part of the same device type as the relays being tested, but which is not subjected to any of the stresses that are applied to the test specimens. It is used to verify the repeatability and accuracy of measurements.

Trace number. The trace number is the number assigned by the procurement document to link a part number to a specific purchase order or Order Release.

Delta Δ calculation. The delta Δ calculation is the comparison of the measurement after stress has been applied with that recorded prior to application of that stress.

Screening. Screening consists of the Group A inspections performed on 100% of the parts.

Quality conformance inspection (QCI). QCI consists of the Group B inspections required for each lot.

Filename: CS515579.F
Directory: H:\USERS\514\SPECS\ACT-GENL
Template: F:\USERS\JSANSONE\MSOFFICE\WINWORD\TEMPLATE\NORMAL.DOT
Title:
Subject:
Author: Jennifer Sansone
Keywords:
Comments:
Creation Date: 08/10/95 1:16 PM
Revision Number: 1
Last Saved On:
Last Saved By:
Total Editing Time: 2 Minutes
Last Printed On: 08/10/95 1:22 PM
As of Last Complete Printing
Number of Pages: 15
Number of Words: 4,278 (approx.)
Number of Characters: 24,386 (approx.)